

# **FOOD STANDARDS AGENCY**

## **MICROBIOLOGICAL SAFETY DIVISION**

### **PROCEEDINGS OF THE REVIEW OF PROGRAMME B15 EGG RESEARCH**

**Held at the Royal College of  
Physicians, London, UK**

**Tuesday 29<sup>th</sup> June, 2004**

## **1. EXECUTIVE SUMMARY**

1.1 Over 60 delegates from different sectors including industry, academia and Government attended a review of the Food Standards Agency (FSA, the Agency) programme of research, Programme B15 Eggs (and Poultry), concerning the major pathogen linked to eggs, i.e. *Salmonella* Enteritidis.

1.2 The main aim of the review was to evaluate each of the research projects funded under the programme and to facilitate discussion on possible future areas of research. The review also evaluated how well the research has met the aims and objectives of the programme's original ROAME, the rationale for the programme. In order to carry out this evaluation process the FSA invited its contractors to present their research to an external panel of experts, chaired by Professor Duncan Maskell.

## **2. FSA ACTION PLAN**

- To publish the proceedings of the B15 Egg Programme Review (following delegate consultation).
- To provide feedback to the individual contractors on the evaluation of their project by the independent panel of experts so that both the Agency and its contractors benefit from the programme review process.
- If appropriate, to consider funding for a new egg research programme, consult widely on the draft and publish research requirements from the RCU-B1 (ROAME) programme specifications.

### **3. SUMMARY OF PRESENTATIONS**

#### **Introduction**

3.1 The chairman, Professor Duncan Maskell welcomed delegates to the review of the Agency's Programme of Egg Research (B15) and provided an overview of the review process.

3.2 Delegates were informed that the *Review of the Food Standards Agency Research Portfolio and Research Management Systems* (the Arbuthnott Review), published in July 2001, recommended that each of the Agency's existing research programmes should be reviewed according to a clearly defined timetable to ensure they meet the aims and objectives of the Agency and are providing value for money. In response to this recommendation, the Food Standards Agency (FSA) has undertaken to review all its research programmes by means of a formal independent evaluation. The review process is an opportunity for the Agency to take stock of completed research and identify areas that still need addressing.

3.3 This review covered research funded under the egg component of the Eggs and Poultry Programme (B15). It was noted that the poultry sub-programme of research had been reviewed at a separate meeting in January 2004. Delegates were reminded that it was not the intention to discuss issues relating to the poultry research in this forum.

3.4 The main aim of the review was to evaluate each of the research projects funded under the programme and to facilitate discussion on possible future areas of research. The review also evaluated how well the research had met the aims and objectives of the programme's original ROAME, the rationale for the programme. The programme also provided a mechanism to inform stakeholders about the results of egg research funded by the Agency to date and to seek their ideas and input to inform the need for any further work in this area.

3.5 In order to carry out this evaluation process, the FSA invited its contractors to present their research to an external panel of experts. The evaluation panel consisted of Professor Duncan Maskell, University of Cambridge and a member of the Agency's Advisory Committee on Research, Professor Geoff Mead an independent consultant in food microbiology and Professor Mac Johnson of the Royal Veterinary College.

### 3.6 Introduction to Programme B15 Research on Eggs

Presented by Dr Andrea Belcher, Microbiological Safety Division, Food Standards Agency.

3.6.1 Dr Belcher gave a presentation that provided the history context to the programme and an overview of related surveillance activities. One of the major influences for the egg research programme was the Advisory Committee on Microbiological Safety of Food (ACMSF) reports on *Salmonella* in Eggs. The first report was published in 1993 and after this, the predecessor to the Food Standards Agency<sup>1</sup> published a research requirement calling for research projects focussed on eggs. As a result of that call the programme of 4 projects was initiated in late 2000.

3.6.2 The four areas of research that were funded fit within the recommendations from the ACMSF, and a project was funded in each of the following areas:

- Growth of *Salmonella* in eggs.
- Survival on eggshells and potential for cross contamination.
- Advances in egg washing and the impact of washing on *Salmonella* present on eggshells.
- Adherence to Government advice in the catering industry.

3.6.3 In addition to the programme of research, important information about the levels of *Salmonella* contamination associated with eggs has been obtained from surveys. In the recent past, surveys of UK produced eggs have been carried out in 1991, 1995/6 and most recently an UK wide survey was carried out by the FSA in 2003<sup>2</sup>. The results of the 2003 survey showed that the overall prevalence of *Salmonella* in a box of six eggs was 0.34% for the UK as a whole, i.e. around 1 box in every 290 boxes. When the 2003 data for samples collected from England is compared with the 1995/6 survey result which was carried out in England only, the comparison shows a three fold reduction in the prevalence of *Salmonella*. This suggests that the package of measures, including vaccination, that was put in place by the UK egg industry since the early 1990s has had a significant impact on *Salmonella* in the laying sector.

3.6.4 The Agency is aware of the importance of following up the recent survey of UK produced eggs with a survey on non-UK eggs which will start in March 2005 and will continue for 14 months.

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<sup>1</sup> JFSSG (Joint Food Safety and Standards Group)

<sup>2</sup> The report of the UK wide survey of Salmonella Contamination of Eggs (B18007) can be located on the Agency's website at:  
<http://www.food.gov.uk/multimedia/pdfs/fsis5004report.pdf> (and the annexes are included at <http://www.food.gov.uk/multimedia/pdfs/fsis5004reportannexes.pdf> )

### **3.7 Overview of Defra funded research on eggs at the Veterinary Laboratories Agency**

Presented by *Dr Rob Davies, Veterinary Laboratories Agency*

3.7.1 Dr Davies provided an overview of the Department for the Environment, Food and Rural Affairs (Defra) funded research on eggs conducted at the Veterinary Laboratories Agency (OZ0317 – Epidemiological Investigations of *Salmonella* contamination in table egg production). The work was completed in 2003 and aimed at preventing persistence of *Salmonella* Enteritidis infection on farms and avoiding repeated flock infections and contamination of eggs. The study included commercial farms, a hatchery, breeder and rearing sites, along with post mortems on spent hens. In all, 13,640 eggs were cultured. The project looked at the distribution of *Salmonella* on commercial laying farms, the effectiveness of disinfection, vaccination and cross contamination in the egg packing house. The outcome will help to inform any future revision of guidance documents available to the layer industry.

3.7.2 The study identified that:

- hatcheries were not a major source of *Salmonella* for the egg industry, although intermittent short term contamination could occur.
- effective cleaning and disinfection of infected pullet rearing houses was relatively easily achieved.
- most infected flocks were not detected by current industry *Salmonella* monitoring programmes.
- vaccination has helped to reduce the incidence of *Salmonella* in birds and in/on eggs and the farm environment. Vaccination has reduced the within-flock prevalence on farms by reducing the shedding of *Salmonella* Enteritidis by chickens.
- the introduction of vaccination for *S. Enteritidis* led to the eradication of infection in most free-range and barn systems but not in cage systems.
- wildlife, and in particular mice on farms, were found to be carriers of *Salmonella*, as were flies. Maintenance of infection on the farm was associated with poor cleaning and disinfection and recontamination by these wildlife carriers was found to be a problem on most farms investigated.
- environmental contamination from the egg packing houses was found to contribute to up to a 0.3% prevalence of *Salmonella* on the eggshell in a study of the passage of sterile eggs.

- the same strain of *Salmonella* Enteritidis was found to be present over four consecutive flock changes (over a period of four years) on several farms despite the importance of cleaning being highlighted.

3.7.3 The original Defra funded study has been followed by Project OZ0321 – Investigation of the role of environmental contamination in the epidemiology of *Salmonella* infection in egg laying flocks. This project is on going and is to be completed during 2005. To date it has demonstrated that poor cleaning, disinfection and rodent control standards are continuing to contribute to the persistence of *Salmonella* but use of a particular formaldehyde based combination product has been successful in many houses. Quantitative studies have shown a large degree of variability in *Salmonella* excretion, contamination of the poultry house environment and infection of birds exposed to environmental samples. Various new vaccination programmes are in place and are being observed in longitudinal studies. Survival characteristics of isolates are also being studied to help elucidate the epidemiology of persistent flock infection.

### **3.8 Project B03015: A study to examine the egg-to-egg variations in the growth of *Salmonella* spp. in egg contents**

Prof. T Humphrey                      University of Bristol

3.8.1 The aim of this study was to identify the factors that allow *Salmonella* Enteritidis to survive and multiply within the egg and to compare these to other serovars of *Salmonella*.

3.8.2 Specific factors including high levels of glucose and a low capacity of the iron-binding proteins in the albumen were found to be linked to high levels of bacterial growth in the egg contents.

3.8.3 *Salmonella* Enteritidis was found to have a number of abilities that allow growth to a high level. It was able to survive well in the albumen at hen body temperature and it could use the glucose present in fresh eggs as an energy source. The combination of certain surface structures and the ability to survive in the albumen shown by *S. Enteritidis* is not shared by other *Salmonella* serovars that have been widespread in the past, such as serovars Gallinarum, Pullorum and Typhimurium.

3.8.4 Other findings indicate that at the end of laying life of a hen, the eggs produced are smaller and have weaker yolks. This may explain why older hens are more likely to lay *Salmonella* positive eggs. Genetic differences between hens lead to differing *Salmonella* growth between eggs. This is linked to the iron-binding capacity of the albumen. Studies, which have examined the growth kinetics of *Salmonella* in eggs, have shown that, at 20C there is a delay of 2-3 weeks before *Salmonella* grows rapidly. Vaccination of hens delays but does not prevent the growth of *Salmonella*.

3.8.5 The project leader was asked his opinion of the implications of this project on advice for egg handling and storage. Prof. Humphrey replied that eggs should be regarded as perishable and should probably be refrigerated. It was noted that, as around 5% of contaminated eggs exhibited high levels of *Salmonella* growth within the egg contents, and with the relatively low prevalence demonstrated in the recent survey<sup>3</sup> it may only be around 1 in 10,000 eggs where growth to high levels occurs. However, it was felt that refrigeration was still needed, especially by consumers, to delay onset of *Salmonella* growth.

3.8.6 In experiments using eggs artificially contaminated with *S. Enteritidis*, rapid growth after a few days had been observed in a small proportion of the eggs. It is not clear whether this growth is real (i.e. occurs in naturally contaminated eggs) or it is an artefact of the methodology. Prof. Humphrey indicated that because it was not possible to get naturally contaminated eggs the question had not been answered as well as they would have liked.

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<sup>3</sup> B18007 – UK-wide Survey of Salmonella Contamination of Eggs

### **3.9. Project B03016: Cross contamination from the external surface of eggs in relation to risk of exposure to *Salmonella*.**

Dr J Sutherland London Metropolitan University

3.9.1 This project aimed to consider the survival behaviour of *Salmonella* strains on the surface of the egg and the extent to which transfer from the eggshell occurs during handling and food preparation. Dr A. Varnam presented the key findings of the project on behalf of Dr J Sutherland.

3.9.2 Survival studies gave variable results but the numbers of organisms, which survived on the eggshell generally declined over time. However, it was never possible to say that *Salmonella* was not present. The possibility that a small number of cells enter a viable but non-recoverable (VNR) state on the eggshell was also investigated and shown not to be the general pattern of behaviour. Studies concerning transfer of *Salmonella* from the eggshell into egg contents on breaking, to gloved hands and onto simulated work surfaces showed that, in all cases, transfer rates were relatively high, with transfer to gloved hands being 90 to 100% under moist conditions. Transfer into the egg contents on breaking and onto simulated work surfaces was also high, although rates were generally lower than onto gloved hands. This is not found with naturally contaminated eggs which have a much lower level of surface contamination.

3.9.3 A general discussion followed the project presentation. On the point of behaviour of organisms during storage there was a query about whether there would be migration of inhibitory factors as well as water from the egg content. Dr Varnam indicated there would be but that the availability of iron would outweigh the impact of the inhibitory factors.

3.9.4 With regard to the evidence from the study on the relative merits of storage at 4°C and 20°C, Dr Varnam indicated he would favour storage at 4°C because of the other benefits of cold storage, namely the slower growth of any *Salmonella* present.

3.9.5 There was a question about how the eggs had been inoculated to mimic naturally contaminated eggs and Dr Varnam explained in detail how the eggs were inoculated and to what levels.

3.9.6 The report contained a recommendation to discourage the use of egg boxes for craft purposes due to the small risk that *Salmonella* may persist on the boxes. It was felt that the Agency would need to consider the evidence of risk very carefully. Dr Davies indicated that the Defra study had looked at egg boxes on farms and had found very low levels of *Salmonella* present, so he expected the risk from boxes to be very low.



### **3.10 Project B03017: A review of commercial washing with particular emphasis on the control of *Salmonella*.**

Dr A. Moore Direct Laboratories Service Ltd

3.10.1 This project aimed to assess the implications of egg washing practices for the UK egg industry and to determine the effect on shell-borne *Salmonella*.

3.10.2 This study looked at the effects of spray jet washing under different processing conditions to shell surface counts of *Salmonella* and the presence of bacteria in egg contents. When eggs artificially contaminated with *Salmonella* were washed under optimum conditions, *Salmonella* counts were lowered from shell surface by >6 log (1 million fold) and *Salmonella* was not isolated from the egg contents.

3.10.3 There was no evidence that *Salmonella* could be transmitted into the egg contents except when poor egg washing practices were used. Contamination of the egg contents did arise when strict control was not maintained over the wash and rinse water temperatures. The lowering of the wash jet pressure and/or the concentration of the wash additive did not significantly influence removal of *Salmonella* from the shell. However, maintaining the temperature at levels above 40°C (of the wash and rinse water) was the most important factor in reducing *Salmonella* levels on the surface of the eggshell.

3.10.4 A general discussion followed the project presentation. It was suggested that the practice of egg washing using the bucket washing approach seemed to be more hazardous than washing using a spray jet. It was suggested that both methods involved some degree of cuticle damage. This makes it more likely that subsequent wetting of the shell surface would result in transfer of bacteria to the egg contents.

3.10.5 The project leader provided details about the time delay between egg laying and washing employed during the study. This was carried out in the order of a couple of hours.

3.10.6 The project had developed a blueprint for how to undertake washing safely and the audience was interested in how this may have differed from what the egg washing machine manufacturers recommended. Dr Moore indicated that the time and temperature settings were generally in agreement with manufacturers' instructions but there were slight differences in the levels of chlorine solution added to the wash water.

3.10.7 The audience was aware that work in the US had demonstrated that there was an increase in the temperature of the eggs during washing that was retained during packaging and that this increased temperature encourages growth of internal contaminants. Unfortunately this research project could not

add any new information on this, as there was no testing of eggs after storage. The eggs were tested immediately after washing.

3.10.8 The discussion moved on to cover those areas where egg washing could be used to reduce the risk of the presence of *Salmonella*. Suggestions included farms where *Salmonella* had been isolated, however doubts were raised about the increased costs.

### **3.11 Project B03018: A pilot study to estimate the nature and extent of adherence to government guidance on safe egg use in the catering sector**

Prof. E Taylor          University of Salford

3.11.1 Dr Kane presented the project findings on behalf of Prof. Taylor. This project aimed to identify the level of awareness of government guidance on egg safety in a representative sample of catering business, to determine the extent that guidance is incorporated into the day to day catering activities and whether the current practice is presenting a significant risk. This project ended in July 2001.

3.11.2 A hundred premises comprising twenty-five nursing homes, restaurants, sandwich operations and function caterers were visited over a two-month period. Little awareness of food safety risk associated with eggs was found within the 100 premises investigated. More importantly, in terms of practice, the results indicate that recommended good practice is not widespread with evidence for concern in all four sectors studied. In particular, nursing homes did not appear to be better informed or use better practices than the other sectors investigated, despite the 'vulnerable' nature of the client group. The findings also identified the failure of Basic Food Hygiene training to address egg safety and the extremely limited uptake of food safety management systems based on HACCP (Hazard Analysis and Critical Control Point) principles.

3.11.3 As part of the project, discussions with representatives of the catering industry, LACORS (Local Authorities and Co-ordination of Regulatory Services) and others concluded that the sample was likely to be representative of the UK. However they recommended that the study should be extended to confirm this. The resulting evidence could then be used to inform a concerted action plan within the catering industry as a whole. This was considered essential if the successes of initiatives further down the food chain are not to be jeopardised within the UK. Such a study would also provide essential base-line data on HACCP implementation<sup>4</sup>.

3.11.4 A general discussion followed the project presentation. Dr Kane was asked his opinion of what the results might be if the study was repeated next year to which he replied that it was his view that the findings would be the same or worse. He did not feel there was any reason to suggest that an improvement could be expected.

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<sup>4</sup> The findings from this survey were presented to ACMSF in October 2001. Members felt generally that the sum of knowledge was unlikely to be improved significantly by extending the survey nation-wide. Minutes from this meeting are located on the Agency's website at: [http://www.food.gov.uk/science/ouradvisors/microbiogsafety/acmsfmeets/55761/41/acmsf\\_meeting\\_minutes](http://www.food.gov.uk/science/ouradvisors/microbiogsafety/acmsfmeets/55761/41/acmsf_meeting_minutes)

3.11.5 There was a discussion about the use of pasteurised egg by caterers and it was explained that, whilst pasteurised egg is available from wholesalers, it costs 10-20% more than shell eggs. There was evidence from the study that many caterers were not aware of its existence or how it should be used.

## **4 SESSION II: RECOMMENDATIONS FOR FUTURE RESEARCH PRIORITIES**

Prof. Duncan Maskell chaired this session, which was an open discussion of projects and findings. There was a general consensus amongst the delegates that further research into *Salmonella* and eggs was necessary though it might not be appropriate for the Agency to take the suggestions forward. Delegates were invited to discuss future research priorities for the Agency to consider.

Each of the four areas covered by the Agency's Egg research programme was discussed in turn to determine whether the projects had identified any further research priorities.

### **4.1 Egg washing**

4.1.1 Alternatives to the use of chlorine in egg washing suggested that oxidising water might be suitable. When *Salmonella* is known to be present on the shells, the use of UV light or a laser with photoreactive chemicals could be considered if the hurdle of getting killing power into the pores of the eggshell could be addressed. This led to a question of whether we have sufficient evidence to determine the location of *Salmonella* on the eggshell and a suggestion that more work is required to determine the natural distribution of *Salmonella* on eggshells.

4.1.2 Researchers were asked for their view on whether eggs should be washed or not. It was also recommended that there should be a risk assessment of the growth of organisms that end up inside the egg as a result of washing (*Salmonella* as well as spoilage organisms). The general opinion was that if a risk assessment approach were undertaken the disadvantage of the potential cost would most likely outweigh any benefits gained.

4.1.3 It was suggested that egg washing could be a useful tool for targeting farms known to be infected with *Salmonella*, the caveat being that it could only decrease levels on the outside of shells and could not improve any contamination of the contents. It was felt that, in general, the retail sector would not be in support of introducing washing and, if introduced, it might be necessary to register or licence premises in an attempt to maintain standards.

### **4.2 Physiology of *Salmonella* Enteritidis infections**

4.2.1 This was followed by a discussion about the key features of *S. Enteritidis* that means that it can contaminate the egg contents as opposed to other *Salmonella* serovars. It was agreed that there was a lack of understanding of the natural history of *Salmonella* Enteritidis infections and other factors such as survival and virulence characteristics.

### **4.3 Infection, vaccination and other control measures**

4.3.1 It was noted that the egg industry is considering the use or development of a vaccine to protect against Group C *Salmonella* (i.e. *Infantis*, *Virchow*, *Newport*, *Hadar*, etc...). It was agreed that there is a deficiency in

knowledge about how the current vaccines work, the relative efficacy of different vaccine options and whether cross protection could be developed.

4.3.2 It was felt that definitive quantitative information on the benefit of vaccinated versus non-vaccinated flocks was still not available and that a controlled trial comparing different vaccination programmes was required. In addition there is also a recognised lack of data on the benefits of competitive exclusion in layer flocks to prevent *Salmonella* infection. Competitive exclusion was understood by the delegates to work in some broiler flocks but the supporting data in layer flocks, where physiological stress may change the gut flora, was lacking. There seemed to be data available from Germany that indicates that there is a synergistic effect between vaccination and competitive exclusion but it was felt that improved approaches to competitive exclusion and delivery of vaccine were needed.

4.3.3 One of the findings from project B03015 was that older hens may be more susceptible to *Salmonella* infection than younger birds, although the reasons for this are not clear this is often associated with cumulative physiological stress resulting from intensive egg laying and the waning of vaccinal protection. More work is required to define means of extending or boosting vaccinal protection at the end of lay.

4.3.4 More work is needed to define improved interventions for persistently contaminated farms by controlled intervention study. This requires the co-operation of farmers which is currently lacking because of financial constraints and the cost of improvements as well as a general unwillingness to carry out sampling which will increase the likelihood of detection of *Salmonella*.

4.3.5 *Salmonella* from eggs is known source of infection however it is not known whether there is any association between *Campylobacter* and eggs – It was noted that *Campylobacter* can contaminate chicken reproductive tissue but there was no outbreak or other data to support eggs as a vehicle of *Campylobacter* infection.

#### **4.4 Catering**

4.4.1 In terms of the catering trade, it was felt that there is a lack of trend data relating to catering practices and the risks posed by eggs. There was a suggestion that there might be some merit in repeating the study presented at the meeting to ensure that there is some consistency in the questions and approach used so that comparisons can be made.

## **5 CONCLUSIONS**

5.1 The general consensus amongst the delegates attending the review was that there was a need for further egg research but that perhaps it would be better to consider research in terms of the relationship between *Salmonella* and its animal host rather than focus on eggs.

5.2 The industry's view on priorities for further work was to focus on education in the catering sector, undertake a survey of non-UK eggs, followed by work to support a better understanding of vaccination.

5.3 The overall outcome of the discussions to identify future concerns and research areas have been drawn into the following recommendations for future research:

**I. Understand the natural history of *Salmonella* Enteritidis infections by:**

- gaining a better understanding of why *Salmonella* Enteritidis is so well suited to grow and survive in and on eggs compared to other serovars of *Salmonella*.
- gaining a better understanding of the virulence characteristics and mechanisms which by *Salmonella* is able to infect eggs.

**II. Biological controls, vaccines and competitive exclusion to control *Salmonella* Enteritidis by:**

- understanding the effectiveness of the currently available vaccines for *S. Enteritidis*, to determine how they provide protection, the role of the immune mechanism and the length of protection offered.
- investigating to determine the suitability of differing vaccines, attenuated or killed strains.
- researching to determine whether it is more appropriate to focus on protecting the chicken or the egg from *S. Enteritidis* infection.
- understanding of any possible protective benefits from the use of probiotics and/or competitive exclusion.

**III. Understand the predisposition of some flocks to greater growth of *Salmonella* Enteritidis by:**

- considering the role of laying flock husbandry, e.g. diet, welfare, genetics as possible factors for potential *S. Enteritidis* infection.
- understanding the mechanisms that apparently make older laying hens more vulnerable to infection with *S. Enteritidis*.

**IV. Measures to reduce the presence of *Salmonella* on the shell of the egg and therefore reduce the risk of cross contamination by:**

- investigating novel measures to reduce the presence of *Salmonella* in the egg packing house, such as UV light, use of lasers and photoreactive chemicals.
- understanding the mechanism and location of *Salmonella* adherence to the eggshell surface.
- undertaking exploratory investigations to determine whether *Campylobacter* could adhere to the egg and whether this could be an additional source of human infection.

**V. The need for further advice to consumers and caterers on the safe handling of eggs by:**

- furthering understanding of the uptake of advice by conducting a large prospective study across the UK to determine trends.
- improving communication of the risks associated with the improper handling of eggs by conducting research to determine the best methods to inform caterers and consumers, and bring about a change in behaviour.



## ANNEX I- PROGRAMME

### REVIEW OF THE B15 – EGG RESEARCH PROGRAMME

29 June 2004

Royal College of Physicians, London

9.15 – 10.00	<b>Registration Tea/coffee Reception</b>
10.00 – 10.10	Chair's opening remarks <b>Professor Duncan Maskell, University of Cambridge</b>
10.10 – 10.20	Introduction to Programme B15's research on eggs <b>Dr Andrea Belcher, Food Standards Agency</b>
10.20 – 10.40	Overview of Defra funded research on eggs <b>Dr Rob Davies, Veterinary Laboratories Agency</b>
	<b><u>Session I: B15 Egg Research</u></b>
10.40 – 11.05	Project B03015: A study to examine the egg-to-egg variations in the growth of Salmonella spp. In egg contents
11.05 – 11.30	Project B03016: Cross contamination from the external surface of eggs in relation to risk of exposure to Salmonella
11.30 – 11.45	<b>Morning Tea and Coffee</b>
11.50 – 12.15	Project B03017: A review of commercial egg washing with particular emphasis on the control of salmonella
12.15 – 12.40	Project B03018: Pilot study to estimate the nature and extent of adherence to government guidance on safe egg use in the catering industry
12.40 – 1.00	Open discussion of projects and findings

**1.00 – 2.00**

**Lunch**

**Session II: B15 Eggs Research Workshop**

**2.00 – 2.45**

Open session to discuss future research priorities  
**Mr Kevin Woodfine, Food Standards Agency**

**2.45 – 3.00**

Chair's summing up

**3.00**

**Close of open review**

**3.00 – 4.00**

Closed review for independent panel of experts only

## **ANNEX 2- EGG REVIEW ROAME**

### **Aim of the research**

*Salmonella* contamination of eggs was one of the main microbiological food safety issues of the 1990s. Despite the significant effort directed at reducing the *Salmonella* contamination of eggs, there is the need for further research in this area. A Department of Health funded survey carried out in 1995/96 gave similar results to one conducted in 1991, i.e. that approximately 1 in 600 eggs were contaminated with *Salmonella*, with the majority of the contamination thought to be on, as opposed to in, the egg.

Since then the Advisory Committee on the Microbiological Safety of Food Working Group on *Salmonella* in Eggs was set up to establish the factors which determine the presence of *Salmonella* contamination in or on eggs and to recommend measures to reduce such contamination and consumers exposure to it. The first report of this group, published in 1993, highlighted some areas where it was felt further research were required. This programme will be commissioned to provide information in these areas.

### **Reason for FSA to fund research**

The work will contribute to the Agency's know how in terms of the potential eggs may pose as a route of contamination and it will therefore inform the Agency's policy and advice in this area. In particular the findings from the research on the potential of cross contamination from the surface of contaminated eggs should allow the Agency to develop relevant material for future public education campaigns on safe handling of eggs. The programme will also look at the current practices and knowledge among caterers and offers insight into what needs there are for further education.

### **Objectives of the research**

#### **Project 1 : Growth of *Salmonella* in eggs**

- examine the effects of bird age on the ability of eggs to support/control the growth of *Salmonella*
- correlate changes in egg quality with *Salmonella* growth rates
- determine the bacterial factors important in the growth of *Salmonella* in eggs

#### **Project 2 : Potential for *Salmonella* to survive on eggshells and act as a source of cross contamination**

- investigate the survival of *Salmonella* on the egg surface
- determine the ease with which the organisms can be transferred from the egg surface to other surfaces such as hands and kitchen benches
- assess the likelihood that the organism will be transferred from the outside of an egg to the contents during cracking
- assess long term survival and potential for accumulation due to reuse of egg storage containers
- estimate the overall risk to consumers from handling of eggs

#### **Project 3 : Review current state of knowledge about egg washing to update a previous report**

- assess industry practices in the UK where washing is permitted and on other countries
- quantify the extent of *Salmonella* contamination on and within the egg before and after egg washing

#### **Project 4 : Investigate the nature and extent of adherence to Government guidance on the safe use of eggs in the catering industry**

- assess levels of awareness of advice to caterers from the ACMSF recommendations
- assess practices within the businesses related to safe use of eggs

## ANNEX III- PROJECTS FUNDED UNDER THE B15 EGG PROGRAMME

A list of Food Standard Agency-funded projects to be presented and reviewed at this meeting is given in the table below.

Research Requirement	Project Code	Project Title	Contractor	Start	End	Total Cost (£)
A1	B03015	A Study to examine the egg to egg variations in the growth of <i>Salmonella</i> spp in egg contents	Health Protection Agency	1 Aug 2001	30 April 2003	111,324
A2	B03016	Cross-contamination from the external surface of eggs in relation to risk exposure to <i>Salmonella</i>	London Metropolitan University	1 Sep 2000	31 Aug 2003	116,956
A3	B03017	A review of commercial egg washing with particular emphasis on the control of <i>Salmonella</i>	Direct Laboratory Services Ltd	1 Oct 2000	15 Nov 2002	198,208
A4	B03018	A pilot study to estimate the nature and extent of adherence to government guidance on safe egg use in the catering industry	University of Salford	31 Oct 2000	27 July 2001	27,881

## **ANNEX IV- DELEGATE LIST**

<b>Surname</b>	<b>Forename</b>	<b>Organisation</b>
Aldus	Clare	Institute of Food Research
Allen	Viv	University of Bristol
Belcher	Andrea	Food Standards Agency
Bell	Dianne	Department of Agriculture and Rural Development
Betts	Roy	Campden and Chorleywood Food Research Association
Breslin	Mark	Veterinary Laboratories Agency
Bullen	Paul	Department for the Environment, Food and Rural Affairs
Castle	Marion	Food Standards Agency
Chan	Chun-Han	Food Standards Agency
Cook	Paul	Food Standards Agency
Cree	Lynn	Scottish Centre for Infection and Environmental Health
Davies	Zoë	Department for the Environment, Food and Rural Affairs
Davies	Rob	Veterinary Laboratories Agency
Díaz-Fiunte	Daniel	Food Standards Agency
Duddle	Jane	Waitrose Ltd
Dulic	Katarina	Food Standards Agency
Evans	Sarah	Veterinary Laboratories Agency
Gibbs	Paul	Leatherhead Food International Ltd
Gittens	Jason	ADAS
Henderson	Moir	Scottish Egg Producers Retail Association
Hilton	Judith	Food Standards Agency
Horne	Jane	Food Standards Agency Scotland
Howell	Mary	Food Standards Agency
Howell	Stella	Euro Environmental Containers
Humphrey	Tom	University of Bristol
Hutchinson	Mike	Direct Laboratories
Johnston	Mac	Royal Veterinary College
Kainth	Bobby	Food Standards Agency
Kane	Kevin	University of Salford
Kenton	Hazel	Poultry Health Services
King	Peter	National Farmers Union
Lenn	Betty	Department of Agriculture and Rural Development

Lewis	Hannah	Department of Health
Madden	Bob	Department of Agriculture and Rural Development
Malone	Sabrina	Eurofins Scientific Ltd
Martin	Bob	Food Standards Agency
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McCurdy	Gerry	Food Standards Agency Northern Ireland
Mead	Geoff	Independent Consultant
Merry	Mick	Department for the Environment, Food and Rural Affairs
Miller	Patrick	Food Standards Agency
Mitchell	Bob	Health Protection Agency
Moore	Tony	Direct Laboratories
O'Brien	Sarah	Health Protection Agency
Patel	Pradip	Leatherhead Food International Ltd
Pattern	Bruce	Department for the Environment, Food And Rural Affairs
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Purvis	Jim	College of Agriculture, Food & Rural Enterprise (CAFRE) N.I
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Smyth	Joan	Department of Agriculture and Rural Development
Spackman	David	United Kingdom Egg Packers Association
Sparks	Nick	Scottish Agricultural College
Speight	Alan	Food Solutions Associates Ltd.
Stevenson	Peter	Department for the Environment, Food And Rural Affairs
Sutherland	Jane	London Metropolitan University
Taylor	Eunice	University of Salford
Tew	Sarah	Lidl UK GmbH
Thomas	Jennifer	Food Standards Agency
Thorns	Chris	Veterinary Laboratories Agency (VLA)
Tomlinson	Maggie	Department of Health
Tyson	Huw	Biotechnology and Biological Sciences Research Council
Varnam	Alan	London Metropolitan University
Vazquez	Ignacio	Food Standards Agency
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Woodward	Martin	Veterinary Laboratories Agency (VLA)